USER'S GUIDE

3 Gbit/s Serial Attached SCSI Host Adapters

LSISAS3040X
LSISAS3041X, LSISAS3041XL
LSISAS3041E, LSISAS3041EL
LSISAS3442X, LSISAS3442XL
LSISAS3442E, LSISAS3442EL
LSISAS3080X, LSISAS3080XL
LSISAS3800X

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Version 2.0

LSI LOGIC®

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

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2. This device must accept any interference received, including interference that may cause undesired operation.

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- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
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LSI Logic Asia, Inc. Taiwan Branch
10/F, 156, Min Sheng E. Rd., Section 3,
Taipei, Taiwan, R.O.C.
Tel: 886.2.2718.7828
FAX: 886.2.2718.8869

LSI Logic Corporation
North American Headquarters
Milpitas, CA
Tel: 408.433.8000

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Preface

This document is the user's guide for the LSI Logic 3.0 Gbit/s SAS to PCI/PCI-X/PCI Express host adapters referred to as LSISAS host adapters. It contains a functional description of the LSISAS host adapters as well as physical and electrical specifications. It also contains instructions for installing the host adapters and for connecting SAS devices.

Audience

This document assumes that you have some familiarity with Serial Attached SCSI (SAS) devices and PCI/PCI-X/PCI Express devices. This document benefits people installing and using the LSISAS host adapter.

Organization

This document has the following chapters:

- Chapter 1, **Introduction**, describes the LSISAS host adapters.
- Chapter 2, **Hardware Installation**, describes how to install the LSISAS host adapters in a system.
- Chapter 3, **Host Adapter Characteristics**, provides the environmental and electrical specifications for the LSISAS host adapters. This chapter also provides the mechanical drawings and connector locations for the LSISAS host adapters.

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Related Publications

LSI Logic Documents

LSISAS1064 PCI-X to 4-Port Serial Attached SCSI/SATA Controller Technical Manual, Document No. DB14-000274-xx

LSISAS1064E PCI Express to 4-Port Serial Attached SCSI Controller Technical Manual, Document No. DB14-000331-xx

LSISAS1068 PCI-X to 8-Port Serial Attached SCSI/SATA Controller Technical Manual, Document No. DB14-000287-xx

LSISAS1068E PCI Express to 8-Port Serial Attached SCSI Controller Technical Manual, Document No. DB14-000330-xx

Fusion-MPT™ Device Management User's Guide, Document No. DB15-000186-xx

Integrated RAID User's Guide, Document No. DB15-000292-xx

LSI Logic World Wide Web Home Page

www.lsilogic.com

ANSI

11 West 42nd Street
New York, NY 10036
(212) 642-4900

InterNational Committee on Information Technology Standards (INCITIS) T10 Technical Committee

http://www.t10.org

Global Engineering Documents

15 Inverness Way East
Englewood, CO 80112
(800) 854-7179 or (303) 397-7956 (outside U.S.); FAX (303) 397-2740

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PCI Special Interest Group

2575 N. E. Katherine
Hillsboro, OR 97214
(800) 433-5177; (503) 693-6232 (International); FAX (503) 693-8344

Revision Record

Version	Date	Remarks
1.0	2/2005	Initial release provides information about the LSISAS3040X, LSISAS3041X, LSISAS3041XL, LSISAS3442X, LSISAS3442XL, LSISAS3080X, LSISAS3080XL, and LSISAS3800X PCI/PCI-X to SAS/SATA host adapters.
2.0	1/2006	Changed the title of this user guide from *LSISAS (Serial Attached SCSI) PCI/PCI-X Host Adapters User's Guide* to *3 Gbit/s Serial Attached SCSI Host Adapters User's Guide*. Added the LSISAS3041E/LSISAS3041EL and LSISAS3442E/LSIASA3442EL PCI Express host adapters.

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Contents

Chapter 1
Introduction

1.1 Overview 1-1
1.2 Features 1-3
1.3 PCI Performance 1-4
1.3.1 PCI/PCI-X Features 1-4
1.3.2 PCI Express Features 1-5
1.4 Software 1-6

Chapter 2
Hardware Installation

2.1 Quick Installation Instructions 2-1
2.2 Detailed Installation Instructions 2-2

Chapter 3
Host Adapter Characteristics

3.1 Characteristics of the LSISAS Host Adapters 3-1
3.1.1 LSISAS3040X Host Adapter Characteristics 3-2
3.1.2 LSISAS3041X and LSISAS3041XL Host Adapters Characteristics 3-4
3.1.3 LSISAS3041E and LSISAS3041EL Host Adapters Characteristics 3-6
3.1.4 LSISAS3442X and LSISAS3442XL Host Adapters Characteristics 3-8
3.1.5 LSISAS3442E and LSISAS3442EL Host Adapters Characteristics 3-11
3.1.6 LSISAS3080X and LSISAS3080XL Host Adapters Characteristics 3-13
3.1.7 LSISAS3800X Host Adapter Characteristics 3-15

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3.2 Electrical and Environmental Specifications 3-17
3.2.1 Electrical Characteristics 3-17
3.2.2 Thermal and Atmospheric Characteristics 3-17
3.2.3 Safety Characteristics 3-18

Customer Feedback

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Figures

2.1	Installing an LSISAS x4 Host Adapter in a PCI-X Slot	2-3
2.2	Installing an LSISAS x8 Host Adapter in a PCI Express Slot	2-4
3.1	LSISAS3040X Board Layout	3-3
3.2	LSISAS3041X and LSISAS3041XL Board Layout	3-5
3.3	LSISAS3041E and LSISAS3041EL Board Layout	3-7
3.4	LSISAS3442X and LSISAS3442XL Board Layout	3-9
3.5	LSISAS3442E and LSISAS3442EL Board Layout	3-12
3.6	LSISAS3080X and LSISAS3080XL Board Layout	3-14
3.7	LSISAS3800X Board Layout	3-16

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Tables

1.1	LSISAS Host Adapters and Controllers	1-2
1.2	SAS Bandwidths	1-3
1.3	Software Support	1-7
3.1	Maximum Power Requirements	3-17

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Chapter 1
Introduction

This chapter describes the LSI Logic Serial Attached SCSI (LSISAS) PCI/PCI-X/PCI Express host adapters and consists of the following sections:

- Section 1.1, “Overview”
- Section 1.2, “Features”
- Section 1.3, “PCI Performance”
- Section 1.4, “Software”

1.1 Overview

The LSISAS PCI/PCI-X/PCI Express host adapters provide four or eight serial ports for connection to SAS/SATA (Serial ATA) devices. Each port is capable of 3.0 Gbits/s SAS link rates and 3.0 Gbits/s SATA link rates. The PCI-X interface operates as a zero wait state bus master with data bursts up to 1064 Mbytes/s on a 64-bit PCI-X 133 MHz bus. The PCI Express transmission and reception data rate is 2.5 Gbits/s in each direction, yielding a total bandwidth of 5.0 Gbits/s for each full-duplex lane. The LSISAS PCI Express host adapters are implemented using four or eight PCI Express phys, which provide possible host-side maximum transmission and reception rates of up to 4.0 Gbytes/s.

The LSISAS host adapters contain Flash ROM for storing the BIOS and firmware, and NVSRAM for storing nonvolatile RAID information. The LSISAS3442E, LSISAS3442EL, LSISAS3442X, and LSISAS3800X host adapters provide a 128 K x 36-bit PBSRAM memory device for storing SAS Address Port information allowing for connection to more than 128 devices. The LEDs on the host adapters report a heartbeat, activity, and fault conditions when detected by firmware. Fusion-MPT™ firmware operates the host adapter.

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The LSISAS PCI/PCI-X interface is compliant with the *PCI-X Specification,* revision 2.0. The LSISAS PCI Express interface is compliant with the *PCI Express Specification,* revision 1.0a. All PCI software is backwards compliant with previous versions of the PCI/PCI-X specifications. The PCI/PCI-X host adapters are keyed for 3.3 V PCI/PCI-X add-in card slots. The PCI Express host adapters are not keyed for a specific signaling level voltage. The LSISAS implements the PCI Express interface as a x4 or x8 interface. The LSISAS host adapters use either a standard PCI or a low-profile PCI bracket type. The LSISAS host adapter SAS interface is compatible with the *ANSI Serial Attached SCSI Specification*, revision 1.0 and the *Serial ATA Specification*, revision 1.0a.

The functionality of LSISAS host adapters come from either the LSISAS1064/LSISAS1064E controller chips or the LSISAS1068/LSISAS1068E controller chips. The LSISAS1064/LSISAS1064E integrates four high-performance SAS/SATA phys and the LSISAS1068/LSISAS1068E integrates eight high-performance SAS/SATA phys. The design of LSISAS host adapters makes it easy to add SAS interfaces to any computer, workstation, or server with a PCI/PCI-X/PCI Express bus.

Table 1.1 shows the LSISAS controllers and their associated host adapters that support SAS/SATA devices. Boards without an “L” after the numbers in their name use a standard PCI bracket type. Boards with an “L” after the numbers in their name use a low-profile PCI bracket type. Boards with an “X” after the numbers in their name use the PCI-X bus and boards with an “E” after the numbers in their name use the PCI Express bus.

Table 1.1 LSISAS Host Adapters and Controllers

Controllers	LSISAS Host Adapters	PCI Slot
LSISAS1064	LSISAS3040X, LSISAS3041X, LSISAS3041XL	PCI/PCI-X
LSISAS1068	LSISAS3442X, LSISAS3442XL, LSISAS3080X, LSISAS3080XL, LSISAS3800X	PCI/PCI-X
LSISAS1064E	LSISAS3041E LSISAS3041EL	PCI Express
LSISAS1068E	LSISAS3442E, LSISAS3442EL	PCI Express

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1.2 Features

This section lists features of the LSISAS host adapters:

- Supports narrow port and wide port as shown in Table 1.2.

Table 1.2 SAS Bandwidths

Half Duplex	Full Duplex
Narrow Port (1 Lane)—300 Mbytes/s	Narrow Port (1 Lane)—600 Mbytes/s
Wide Port (2 Lanes)—600 Mbytes/s	Wide Port (2 Lanes)—1200 Mbytes/s
Wide Port (4 Lanes)—1200 Mbytes/s	Wide Port (4 Lanes)—2400 Mbytes/s

- Supports SSP, STP, and SMP as defined in the *Serial Attached SCSI (SAS) Specification,* version 1.0.
- Supports SATA as defined in the *Serial ATA Specification,* version 1.0a.
- Provides configurable drive spin-up sequencing on a per-phy basis.
- Simplifies cabling with a point-to-point, serial architecture.
- Provides smaller and thinner cables that do not restrict airflow.
- Provides a serial, point-to-point, enterprise-level storage interface.
- Transfers data using SCSI information units.
- Provides two LEDs for each phy to indicate link activity and faults for the LSISAS3040X, LSISAS3041X, LSISAS3041XL, LSISAS3442X, LSISAS3442XL, LSISAS3800X, LSISAS3041E, and LSISAS3041EL host board adapters (HBAs).
- Provides two light pipes routed through the PCI bracket for the LSISAS3442X, LSISAS3442XL, LSISAS3080X, LSISAS3080XL, LSISAS3800X, LSISAS3442E, and LSISAS3442EL host adapters. One light pipe indicates activity on any phy. The other light pipe indicates a heartbeat or a fault condition.
- Provides compatibility with SATA target devices.

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1.3 PCI Performance

LSISAS host adapter boards support both PCI/PCI-X and PCI Express interfaces. The following lists are of their features.

1.3.1 PCI/PCI-X Features

PCI/PCI-X features of the LSISAS host adapters include:

- PCI/PCI-X Supports a 133 MHz, 64-bit PCI/PCI-X interface that does the following:
  - Operates up to 133 MHz PCI-X
  - Operates at 33 MHz or 66 MHz PCI
  - Supports 32-bit or 64-bit data transfers
  - Supports 32-bit or 64-bit addressing through Dual Address Cycles (DAC)
  - Provides a theoretical 1064 Mbytes/s PCI bandwidth
  - Complies with the *PCI Local Bus Specification*, revision 3.0
  - Complies with the *PCI-X Addendum to the PCI Local Bus Specification*, revision 2.0
  - Complies with the *PCI Bus Power Management Interface Specification*, revision 1.2
  - Complies with the PC2001 Specification
- Provides unequalled performance through the Fusion-MPT architecture
- Provides high throughput and low CPU utilization to offload the host processor
- Presents a single electrical load to the PCI Bus
- Reduces Interrupt Service Routine (ISR) overhead with interrupt coalescing
- Supports 32-bit or 64-bit data bursts with variable burst lengths
- Supports the PCI Cache Line Size register
- Supports the PCI Memory Write and Invalidate, Memory Read Line, and Memory Read Multiple commands

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- Supports the PCI-X Memory Read Dword, Split Completion, Memory Read Block, and Memory Write Block commands
- Supports 16 PCI-X Split Transaction cycles
- Supports backwards compatibility with previous revisions of the PCI specification
- Provides a full 32-bit or 64-bit PCI-X DMA bus master
- Reduces time-to-market with the Fusion-MPT architecture that provides:
  - Single driver binary for SAS/SATA, SCSI, and Fibre Channel products
  - One firmware build that supports all Integrated RAID™ capabilities
  - Thin and easy to develop drivers
  - Reduced integration and certification effort

1.3.2 PCI Express Features

The PCI Express features of the LSISAS host adapters include:

- Provides four or eight PCI Express phys
- Supports a single-phy (1 lane) link transfer rate up to 2.5 Gbits/s in each direction
- Supports x8, x4, and x1 link widths
- Automatically downshifts to a x4 link width if plugged into a x4 connector or into a x8 connector that is wired as a x4 connector
- Provides a scalable interface
  - Single-lane aggregate bandwidth of up to 0.5 Gbytes/s (500 MBytes/s)
  - Quad-lane aggregate bandwidth of up to 2.0 Gbytes/s (2000 Mbytes/s)
  - 8-lane aggregate bandwidth of up to 4.0 Gbytes/s (4000 Mbytes/s)
- Supports serial, point-to-point interconnections between devices
  - Reduces the electrical load of the connection

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  - Enables higher transmission and reception frequencies
- Supports lane reversal and polarity inversion
- Supports PCI Express Hot Plug
- Supports Power Management
  - Supports PCI Power Management 1.2
  - Supports Active State Power Management (ASPM), including the L0, L0s, L1 states, by placing links in a power-savings mode during times of no link activity
- Contains a replay buffer that preserves a copy of the data for retransmission in case a CRC error occurs
- Supports the PCI Express Advanced Error Reporting capabilities
- Uses a packetized and layered architecture
- Achieves a high bandwidth per pin with low overhead and low latency
- PCI Express is software compatible with PCI and PCI-X software
  - Leverages existing PCI device drivers
  - Supports the Memory, I/O, and Configuration address spaces
  - Supports memory read/write transactions, I/O read/write transactions, and configuration read/write transactions
- Provides 4 Kbytes of PCI Configuration address space per device.
- Supports posted and non-posted transactions
- Provides quality of service (QOS) link configuration and arbitration policies
- Supports Traffic Class 0 and one virtual channel
- Supports Message Signaled Interrupts (both MSI and MSI-X) as well as INTx interrupt signaling for legacy PCI support
- Supports end-to-end CRC (ECRC) and Advanced Error Reporting

1.4 Software

The LSISAS host adapters support all major operating systems, as shown in Table 1.3.

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Table 1.3 Software Support

OS Support	Versions
Windows	XP, 2000, Server 2003 32-bit and 64-bit (x86, AMD, and IA-64)
Linux: Red Hat Enterprise Linux	(RHEL) 3 and 4
Linux: SuSE Enterprise Server	(SLES) 8 and 9
Novel NetWare	5.1 and 6.5
Sun Sparc Solaris	2.6, 2.7, 2.8, 2.9, and 2.10
Utilities	Install, Flash and BIOS Configuration Utility

The LSISAS host adapters use the Fusion-MPT architecture for all major operating systems, which allows for thinner drivers for better performance. To obtain a device driver that supports your operating system, contact the LSI Logic Technical Support team at 719-533-7230 or visit our web site at http://www.lsilogic.com.

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Chapter 2
Hardware Installation

This chapter provides both quick instructions and detailed instructions on how to install the LSISAS host adapter. This chapter consists of the following sections:

- Section 2.1, “Quick Installation Instructions”
- Section 2.2, “Detailed Installation Instructions”

2.1 Quick Installation Instructions

The following steps summarizes the installation instructions.

Use these instructions to install your LSISAS host adapter if you are comfortable with the installation procedure. Section 2.2 provides detailed installation instructions.

Step 1. Unpack the host adapter and inspect it for damage.

Step 2. Turn off the system and remove the power cord(s).

Step 3. Remove the cover from the system.

Step 4. Insert the host adapter in an available PCI/PCI-X or PCI Express slot.

Step 5. Secure the bracket to the system’s chassis.

Step 6. Connect the serial cable(s) between the host adapter and the serial hard disk drive(s). Figure 2.1 and Figure 2.2 illustrate the locations of the connectors on your host adapter.

Step 7. Replace the cover and the power cord(s), then power-up the system.

LSISAS host adapter hardware installation is complete.

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2.2 Detailed Installation Instructions

The following steps provide detailed installation instructions:

Step 1. Unpack the host adapter and inspect it for damage.

Unpack the host adapter in a static-free environment. Remove the host adapter from the anti-static bag and inspect it for damage. Contact LSI Logic or your OEM support representative if the host adapter appears damaged.

Step 2. Turn off the system and disconnect the power cord(s).

Turn off the system's power and physically remove the power cord(s) from the system.

Step 3. Remove the cover from the system.

Remove the cover from the system's chassis. Disconnect the system from any networks.

Step 4. Insert the host adapter in an available PCI/PCI-X or PCI Express slot.

Locate an empty PCI/PCI-X or PCI Express slot. Remove the blank bracket panel on the back of the computer that is aligned with the PCI/PCI-X or PCI Express slot you have selected. Save the bracket screw when present.

Align the host adapter to a PCI/PCI-X or PCI Express slot. Press down gently but firmly to properly seat the host adapter in the slot. Figure 2.1 and Figure 2.2 illustrate how to insert the host adapter in a PCI/PCI-X or PCI Express slot.

Note: The PCI/PCI-X HBAs only are keyed for a 3.3 V slot. The keying of edge connector J1 prevents the card from being installed in a 5 V slot.

Step 5. Secure the bracket to the system's chassis.

Install the bracket screw, when present, or engage the system's retention mechanism to secure the host adapter to the system's chassis.

Step 6. Connect the serial cable(s) between the host adapter and the serial hard disk drive(s) (HDD). Figure 2.1 and Figure 2.2 illustrate the locations of the connectors on your host adapter.

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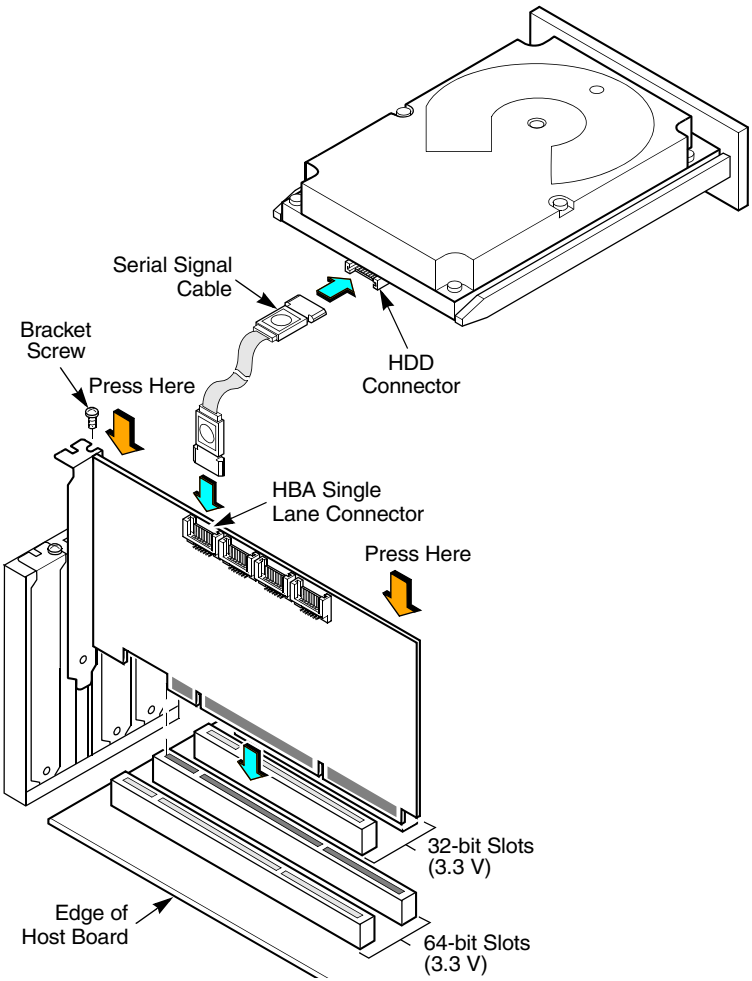
Step 7. Replace the cover and the power cord(s), then power-up the system.

Replace the system's cover, reconnect the power cord(s) and any network cables. Turn power on to the system.

LSISAS host adapter hardware installation is complete.

Figure 2.1 Installing an LSISAS x4 Host Adapter in a PCI-X Slot



Note: The HBA shape, size, and locations of components on your x4 HBA and its bracket may vary from this illustration.

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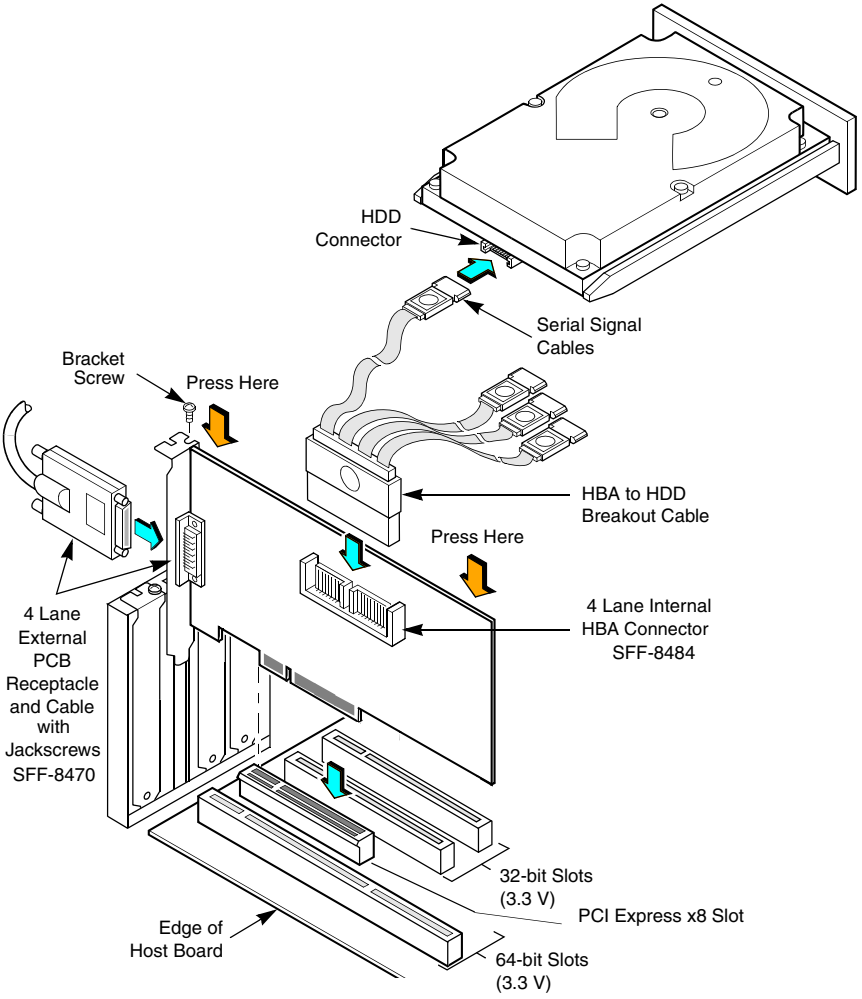
Figure 2.2 Installing an LSISAS x8 Host Adapter in a PCI Express Slot



Note: The HBA shape, size, and locations of components on your x8 HBA and its bracket may vary from this illustration. A PCI Express connector is smaller than a PCI/PCI-X connector.

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Chapter 3
Host Adapter Characteristics

This chapter describes the characteristics of the LSISAS PCI/PCI-X and PCI Express host adapters. The chapter includes these topics:

- Section 3.1, “Characteristics of the LSISAS Host Adapters”
- Section 3.2, “Electrical and Environmental Specifications”

3.1 Characteristics of the LSISAS Host Adapters

The LSISAS host adapters use either the LSISAS1064/1064E controller or the LSISAS1068/1068E controller. The LSISAS1064/1064E controller connects up to four SAS/SATA devices to a computer system through the PCI/PCI-X/PCI Express interface. The LSISAS1068/1068E controller connects up to eight SAS/SATA devices to a computer system through the PCI/PCI-X/PCI Express interface. The LSISAS1064 and the LSISAS1068 support a 133 MHz, 64-bit PCI-X bus. The LSISAS1064E and LSISAS1068E are implemented using four or eight PCI Express phys. Each phy operates at 2.5 Gbits/s which provide possible host-side maximum transmission and reception rates of up to 4.0 Gbytes/s.

The LSISAS1064/1064E and the LSISAS1068/1068E controller chips contain the PCI/PCI-X or PCI Express functionality for the LSISAS host adapters. The controller chip connects directly to the PCI/PCI-X or PCI Express bus and generates timing and protocol in compliance with the PCI, PCI-X, and PCI Express specifications.

The LSISAS1064/1064E and the LSISAS1068/1068E controller chips contain the SAS/SATA functionality for the LSISAS host adapters. The controller chips connect channels directly to the SAS/SATA devices.

The LSISAS host adapters provide up to 4 M x 8-bit Flash ROM for storing the BIOS and firmware. The LSISAS host adapters provide up to

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32 K x 8-bit NVSRAM for storing the nonvolatile RAID information when a system failure happens. The LSISAS3442E, LSISAS3442EL, LSISAS3442X, and LSISAS3800X host adapters provide a 128 K x 36-bit PBSRAM memory device for storing SAS Address Port information allowing for connection to more than 128 devices.

3.1.1 LSISAS3040X Host Adapter Characteristics

The LSISAS3040X host adapter uses a standard PCI bracket as shown in Figure 3.1.

3.1.1.1 LEDs

The LSISAS3040X host adapter has four LEDs, labeled A0-A3, that turn green to indicate an activity condition on any of the four phys. There are four LEDs, labeled F0-F3, that turn amber to indicate a fault condition on any of the four phys. See Figure 3.1 for LED locations. There is one LED that flashes green to indicate the LSISAS1064 heartbeat.

3.1.1.2 Connectors

This section provides a description of the five different connectors on the LSISAS3040X host adapter. See Figure 3.1 for connector locations.

PCI/PCI-X Connector (J1) – The PCI/PCI-X interface operates as a 32-bit or 64-bit DMA bus master. The connection is made through the edge connector J1, which is a +3.3 V type board edge connector. The signal definitions and pin numbers conform to the PCI/PCI-X specifications.

SAS/SATA Connectors (J2–J5) – The LSISAS3040X supports SAS/SATA connections through connectors J2, J3, J4, and J5. These connectors are SATA internal right-angle connectors.

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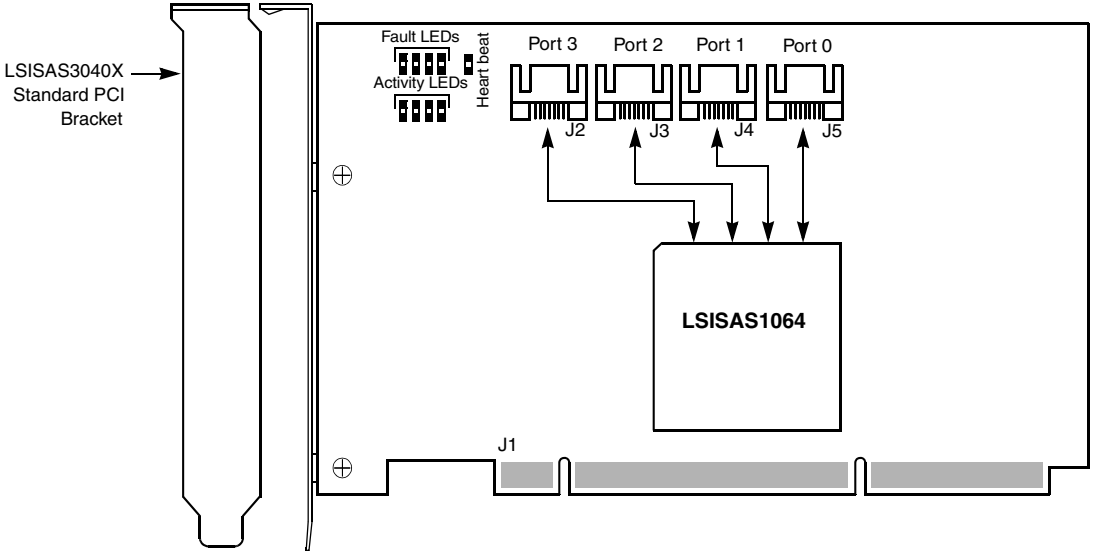
Figure 3.1 LSISAS3040X Board Layout



- J1: PCI/PCI-X 64-bit, +3.3 V type board edge connector
- J2–J5: SATA internal right-angle connectors

3.1.1.3 Physical Characteristics

The LSISAS3040X board is 6.6 inches x 3.4 inches. PCI/PCI-X connection is made through the edge connector J1. The component height on the top and bottom of the LSISAS3040X board follows the PCI/PCI-X specifications.

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3.1.2 LSISAS3041X and LSISAS3041XL Host Adapters Characteristics

The LSISAS3041X and LSISAS3041XL are the same HBA with the exception of the PCI bracket. The LSISAS3041X uses a standard PCI bracket and the LSISAS3041XL uses the low-profile (LPPCI) PCI bracket. Figure 3.2 shows the HBAs and their brackets.

3.1.2.1 LEDs

The LSISAS3041X and LSISAS3041XL host adapters have four LEDs, labeled A0-A3, that turn green to indicate an activity condition on any of the four phys. There are four LEDs, labeled F0-F3, that turn amber to indicate a fault condition on any of the four phys. See Figure 3.2 for LED locations. There is one LED that flashes green to indicate the LSISAS1064 heartbeat.

3.1.2.2 Connectors

This section provides a description of the five different connectors on the LSISAS3041X and LSISAS3041XL host adapters. See Figure 3.2 for connector locations.

PCI/PCI-X Connector (J1) – The PCI/PCI-X interface operates as a 32-bit or 64-bit DMA bus master. The connection is made through the edge connector J1, which is a +3.3 V type board edge connector. The signal definitions and pin numbers conform to the PCI/PCI-X specifications.

SAS/SATA Connectors (J2–J5) – The LSISAS3041X supports SAS/SATA connections through connectors J2, J3, J4, and J5. These connectors are SATA internal right-angle connectors.

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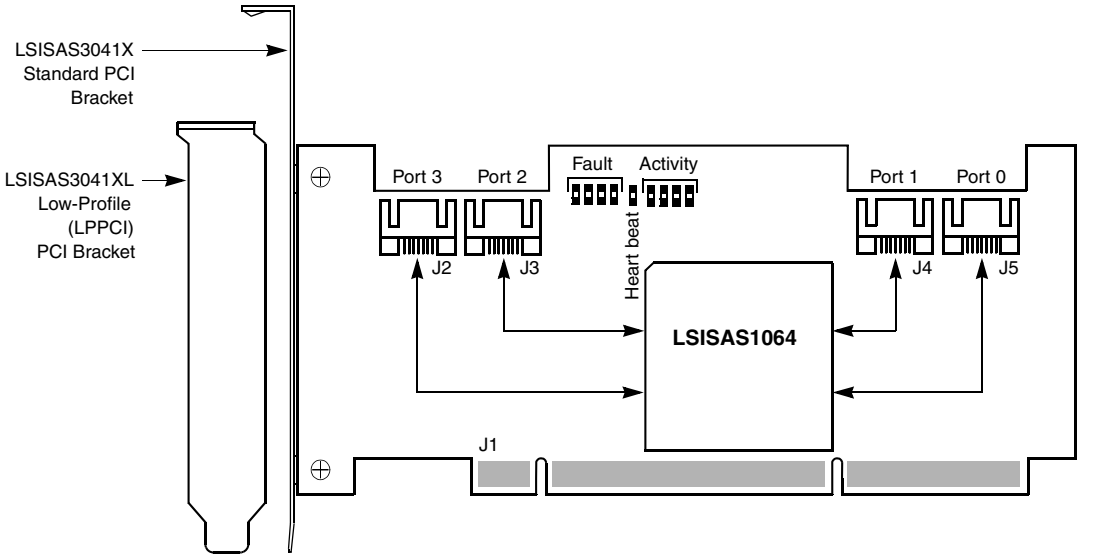
Figure 3.2 LSISAS3041X and LSISAS3041XL Board Layout



- J1: PCI/PCI-X 64-bit, +3.3 V type board edge connector
- J2–J5: SATA internal right-angle connectors

3.1.2.3 Physical Characteristics

The LSISAS3041X and LSISAS3041XL boards are 6.6 inches x 2.536 inches. PCI/PCI-X connection is made through the edge connector J1. The component height on the top and bottom of the LSISAS3041X and LSISAS3041XL boards follows the PCI/PCI-X specifications.

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3.1.3 LSISAS3041E and LSISAS3041EL Host Adapters Characteristics

The LSISAS3041E and LSISAS3041EL are the same HBA with the exception of the PCI bracket. The LSISAS3041E uses a standard PCI bracket and the LSISAS3041EL uses the low-profile (LPPCI) PCI bracket. Figure 3.3 shows the HBAs and their brackets.

3.1.3.1 LEDs

The LSISAS3041E and LSISAS3041EL host adapters have four LEDs, labeled A0-A3, that turn green to indicate an activity condition on any of the four phys. There are four LEDs, labeled LNP0-LNP3, that turn amber to indicate a fault condition on any of the four phys. See Figure 3.3 for LED locations. There is one LED that flashes green to indicate the LSISAS1064E heartbeat and one that flashes green for activity and one that flashes amber for fault in the bracket.

3.1.3.2 Connectors

This section provides a description of the five different connectors on the LSISAS3041E and LSISAS3041EL host adapters. See Figure 3.3 for connector locations.

PCI Express Connector (J1) – The PCI Express interface has four PCI Express phys, which provide possible host-side maximum transmission and reception rates of up to 2.0 Gbytes/s. The PCI Express connection is made through the edge connector J1. The signal definitions and pin numbers conform to the PCI Express specifications.

SAS/SATA Connectors (J2, J5–J7) – The LSISAS3041E supports SAS/SATA connections through connectors J2, J5, J6, and J7. These connectors are SATA internal right-angle connectors.

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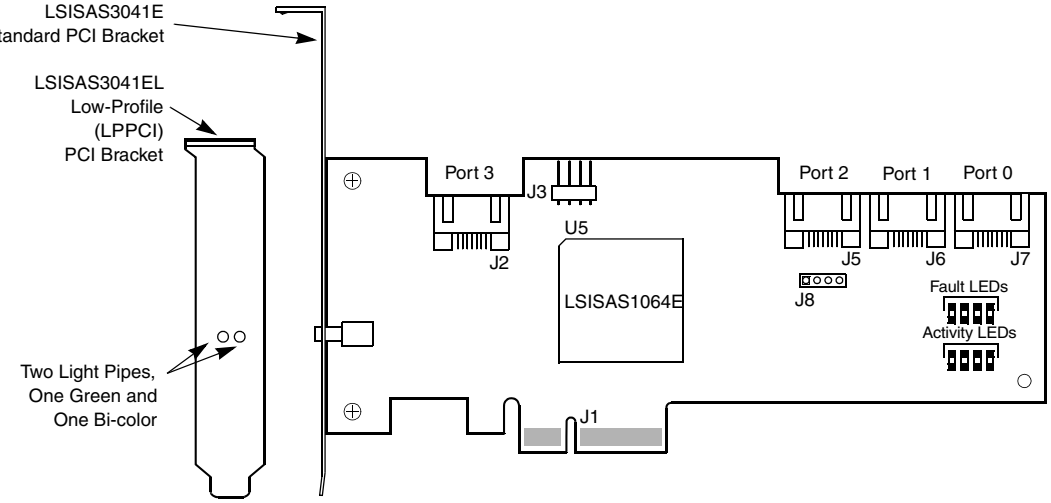
Figure 3.3 LSISAS3041E and LSISAS3041EL Board Layout



- J1: PCI Express x4 type board edge connector
- J2, J5–J7: SATA internal right-angle connectors

3.1.3.3 Physical Characteristics

The LSISAS3041E and LSISAS3041EL boards are 6.6 inches x 2.713 inches. PCI Express x4 connection is made through the edge connector J1. The component height on the top and bottom of the LSISAS3041E and LSISAS3041EL boards follows the PCI Express specifications.

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3.1.4 LSISAS3442X and LSISAS3442XL Host Adapters Characteristics

The LSISAS3442X and LSISAS3442XL are identical HBAs with the exception of the PCI bracket. The LSISAS3442X uses a standard PCI bracket and the LSISAS3442XL uses a low-profile (LPPCI) PCI bracket. Figure 3.4 shows the HBAs and their brackets.

The LSISAS3442X-R is physically identical to the LSISAS3442X and LSISAS3442XL HBAs but also supports the Integrated RAID (IR) options. The two components or Integrated RAID are: Integrated Mirroring (IM) and Integrated Striping (IS). For more information on IR see the *Integrated RAID for SAS User's Guide*.

3.1.4.1 LEDs

The LSISAS3442X and LSISAS3442XL host adapters have eight LEDs, labeled A0-A7, that turn green to indicate an activity condition on any of the eight phys. There are eight LEDs, labeled F0-F7, that turn amber to indicate a fault condition on any of the eight phys. See Figure 3.4 for LED locations.

The LSISAS3442X and LSISAS3442XL host adapters have two light pipes routed through the PCI bracket. One light pipe turns green to indicate activity on any phy. The other light pipe is bi-color. It flashes green to indicate the LSISAS1068 heartbeat, or it turns amber when the LSISAS1068 firmware detects a fault condition.

3.1.4.2 Connectors

This section provides a description of the three different connectors on the LSISAS3442X and LSISAS3442XL host adapters. See Figure 3.4 for connector locations.

PCI/PCI-X Connector (J1) – The PCI/PCI-X interface operates as a 32-bit or 64-bit DMA bus master. The connection is made through the edge connector J1, which is a +3.3 V type board edge connector. The signal definitions and pin numbers conform to the PCI/PCI-X specifications.

SAS/SATA Connectors (J2 and J5) – The LSISAS3442X and LSISAS3442XL support SAS connections through connectors J2 and J5. The J5 connector is an SFF-8484 SAS internal right-angle connector

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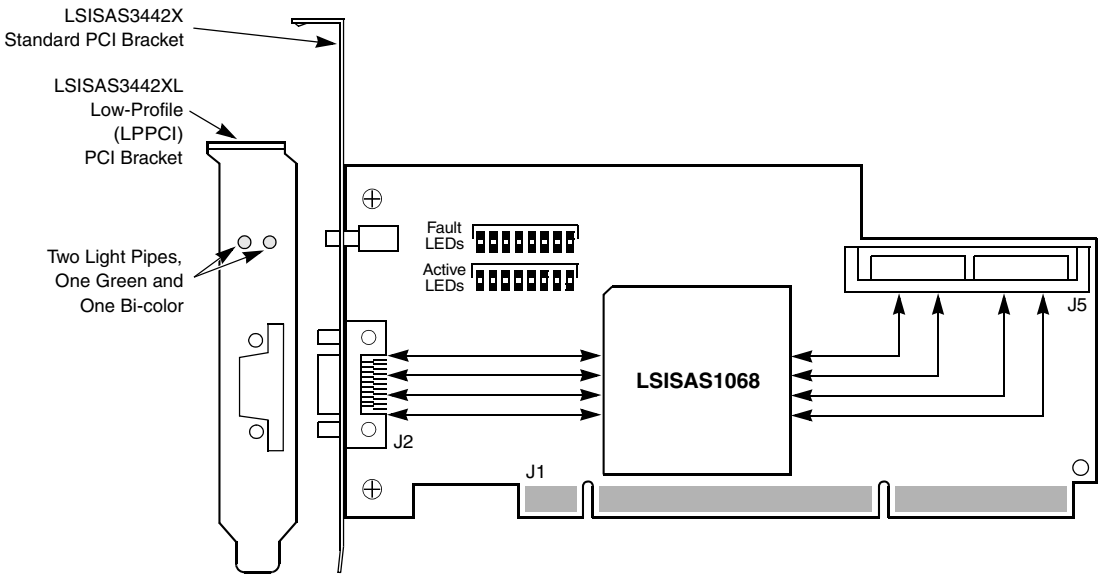
with four sideband lines. The J2 connector is an SFF-8470 SAS external right-angle connector.

J5 contains four Serial General Purpose Input Output (SGPIO) signals. SGPIO is a method to serialize general-purpose IO signals. SGPIO defines the communication between an initiator (for example, a host bus adapter) and a SGPIO target (for example, a backplane holding disk drives). The SGPIO target typically converts the output signals into multiple parallel LED signals and provides the input signals from general-purpose inputs. The SGPIO signals are SCLOCK on pin 14, SLOAD on pin 15, SDATAOUT on pin 18, and SDATAIN on pin 19.

Figure 3.4 LSISAS3442X and LSISAS3442XL Board Layout



- J1: PCI/PCI-X 64-bit, +3.3 V type board edge connector
- J2: SFF-8470 SAS external right-angle connector
- J5: SFF-8484 SAS internal right-angle connector with four sideband lines

3.1.4.3 Physical Characteristics

The LSISAS3442X and LSISAS3442XL boards are 6.6 inches x 2.536 inches. PCI/PCI-X connection is made through the edge connector J1.

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The component height on the top and bottom of the LSISAS3442X and LSISAS3442XL boards follows the PCI/PCI-X specifications.

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3.1.5 LSISAS3442E and LSISAS3442EL Host Adapters Characteristics

The LSISAS3442E and LSISAS3442EL are the same HBA with the exception of the PCI bracket. The LSISAS3442E uses a standard PCI bracket and the LSISAS3442EL uses a low-profile (LPPCI) PCI bracket. Figure 3.5 shows the HBAs and their brackets.

3.1.5.1 LEDs

The LSISAS3442E and LSISAS3442EL host adapters have eight LEDs, labeled A0-A7, that turn green to indicate an activity condition on any of the eight phys. There are eight LEDs, labeled LNP0-LNP7, that turn amber to indicate a fault condition on any of the eight phys. See Figure 3.5 for LED locations.

The LSISAS3442E and LSISAS3442EL host adapters have two light pipes routed through the PCI bracket. One light pipe turns green to indicate activity on any phy. The other light pipe is bi-color. It flashes green to indicate the LSISAS1068E heartbeat, or it turns amber when the LSISAS1068E firmware detects a fault condition.

3.1.5.2 Connectors

This section provides a description of the three different connectors on the LSISAS3442E and LSISAS3442EL host adapters. See Figure 3.5 for connector locations.

PCI Express Connector (J1) – The PCI Express interface has eight PCI Express phys, which provide possible host-side maximum transmission and reception rates of up to 4.0 Gbytes/s. The LSISAS3442E or LSISAS3442EL supports x8, x4, and x1 PCI Express link widths, and automatically downshifts if plugged into either a x4 connector or into a x8 connector that is wired as a x4 connector. The connection is made through the edge connector J1. The signal definitions and pin numbers conform to the PCI Express specifications.

SAS/SATA Connectors (J2 and J5) – The LSISAS3442E and LSISAS3442EL support SAS connections through connectors J2 and J5. The J5 connector is an SFF-8484 SAS internal right-angle connector with four sideband lines. The J2 connector is an SFF-8470 SAS external right-angle connector.

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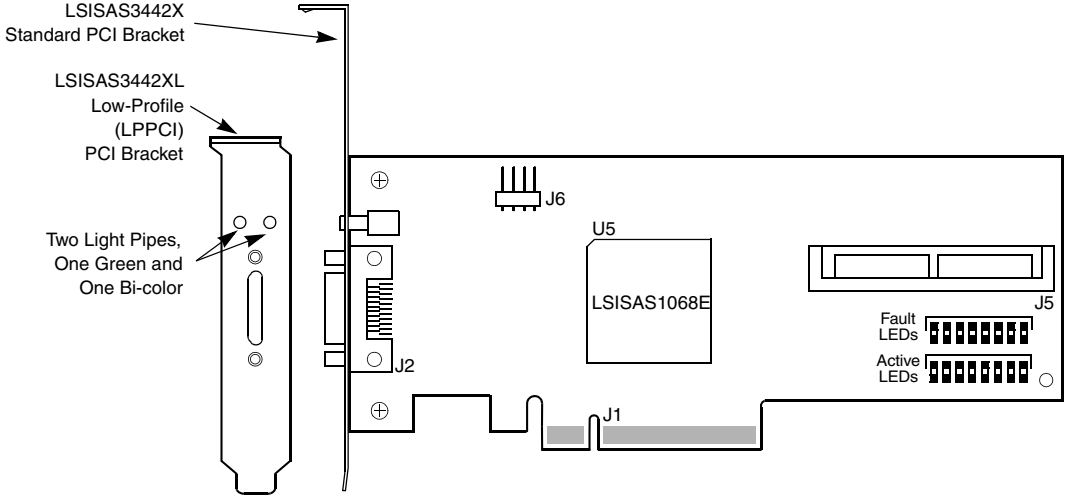
J5 contains four Serial General Purpose Input Output (SGPIO) signals. SGPIO is a method to serialize general-purpose IO signals. SGPIO defines the communication between an initiator (for example, a host bus adapter) and a SGPIO target (for example, a backplane holding disk drives). The SGPIO target typically converts the output signals into multiple parallel LED signals and provides the input signals from general-purpose inputs. The SGPIO signals are SCLOCK on pin 14, SLOAD on pin 15, SDATAOUT on pin 18, and SDATAIN on pin 19.

Figure 3.5 LSISAS3442E and LSISAS3442EL Board Layout



- J1: PCI Express x8, +3.3 V type board edge connector
- J2: SFF-8470 SAS external right-angle connector
- J5: SFF-8484 SAS internal right-angle connector with four sideband lines
- J6: 4-pin, right angle, 0.1” pitch, pin header for driving external activity LED.

3.1.5.3 Physical Characteristics

The LSISAS3442E and LSISAS3442EL boards are 6.6 inches x 2.713 inches. PCI Express x8 connection is made through the edge connector J1. The component height on the top and bottom of the LSISAS3442E and LSISAS3442EL boards follows the PCI Express specifications.

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3.1.6 LSISAS3080X and LSISAS3080XL Host Adapters Characteristics

The LSISAS3080X and LSISAS3080XL are the same HBA with the exception of the PCI bracket. The LSISAS3080X uses a standard PCI bracket and the LSISAS3080XL uses a low-profile (LPPCI) PCI bracket. Figure 3.6 shows the HBAs and their brackets.

3.1.6.1 LEDs

The LSISAS3080X and LSISAS3080XL host adapters have two light pipes routed through the PCI bracket. One light pipe turns green to indicate activity on any phy. The other light pipe is bi-color. It flashes green to indicate the LSISAS1068 heartbeat, or it turns amber when the LSISAS1068 firmware detects a fault condition.

3.1.6.2 Connectors

This section provides a description of the three different connectors on the LSISAS3080X and LSISAS3080XL host adapters. See Figure 3.6 for connector locations.

PCI/PCI-X Connector (J1) – The PCI/PCI-X interface operates as a 32-bit or 64-bit DMA bus master. The connection is made through the edge connector J1, which is a +3.3 V type board edge connector. The signal definitions and pin numbers conform to the PCI/PCI-X specifications.

SAS/SATA Connectors (J2 and J5) – The LSISAS3080X and LSISAS3080XL support SAS/SATA connections through connectors J2 and J5. The J2 and J5 connectors are SFF-8484 SAS internal right-angle connectors with four sideband lines.

J2 and J5 contain four Serial General Purpose Input Output (SGPIO) signals. SGPIO is a method to serialize general-purpose IO signals. SGPIO defines the communication between an initiator (for example, a host bus adapter) and a SGPIO target (for example, a backplane holding disk drives). The SGPIO target typically converts the output signals into multiple parallel LED signals and provides the input signals from general-purpose inputs. The SGPIO signals are SCLOCK on pin 14, SLOAD on pin 15, SDATAOUT on pin 18, and SDATAIN on pin 19.

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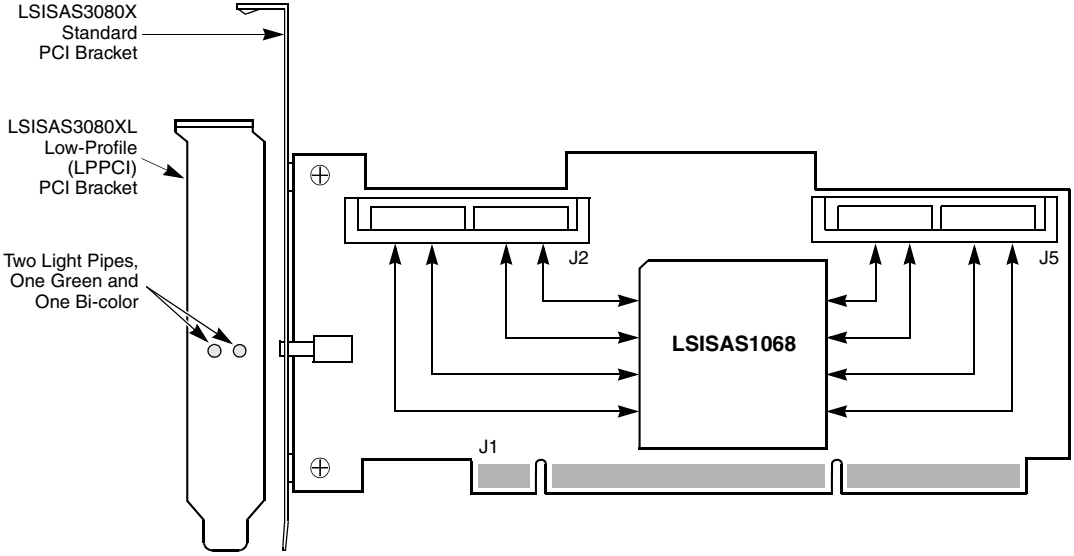
Figure 3.6 LSISAS3080X and LSISAS3080XL Board Layout



- J1: PCI/PCI-X 64-bit, +3.3 V type board edge connector
- J2 and J5: SFF-8484 SAS internal right-angle connectors with four sideband lines

3.1.6.3 Physical Characteristics

The LSISAS3080X and LSISAS3080XL are 6.6 inches x 2.536 inches. PCI/PCI-X connection is made through the edge connector J1. The component height on the top and bottom of the LSISAS3080X and LSISAS3080XL boards follows the PCI/PCI-X specifications.

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3.1.7 LSISAS3800X Host Adapter Characteristics

The LSISAS3800X uses a standard PCI bracket as shown in Figure 3.7.

3.1.7.1 LEDs

The LSISAS3800X host adapter has eight LEDs, labeled A0-A7, that turn green to indicate an activity condition on any of the eight phys. There are eight LEDs, labeled F0-F7, that turn amber to indicate a fault condition on any of the eight phys. See Figure 3.7 for LED locations.

The LSISAS3800X host adapter has two light pipes routed through the PCI bracket. One light pipe turns green to indicate activity on any phy. The other light pipe is bi-color. It flashes green to indicate the LSISAS1068 heartbeat, or it turns amber when the LSISAS1068 firmware detects a fault condition.

3.1.7.2 Connectors

This section provides a description of the three different connectors on the LSISAS3800X host adapter. See Figure 3.7 for connector locations.

PCI/PCI-X Connector (J1) – The PCI/PCI-X interface operates as a 32-bit or 64-bit DMA bus master. The connection is made through the edge connector J1, which is a +3.3 V type board edge connector. The signal definitions and pin numbers conform to the PCI/PCI-X specifications.

SAS/SATA Connectors (J2 and J5) – The LSISAS3800X supports SAS connections through connectors J2 and J5. The J2 and J5 connectors are SFF-8470 SAS external right-angle connectors.

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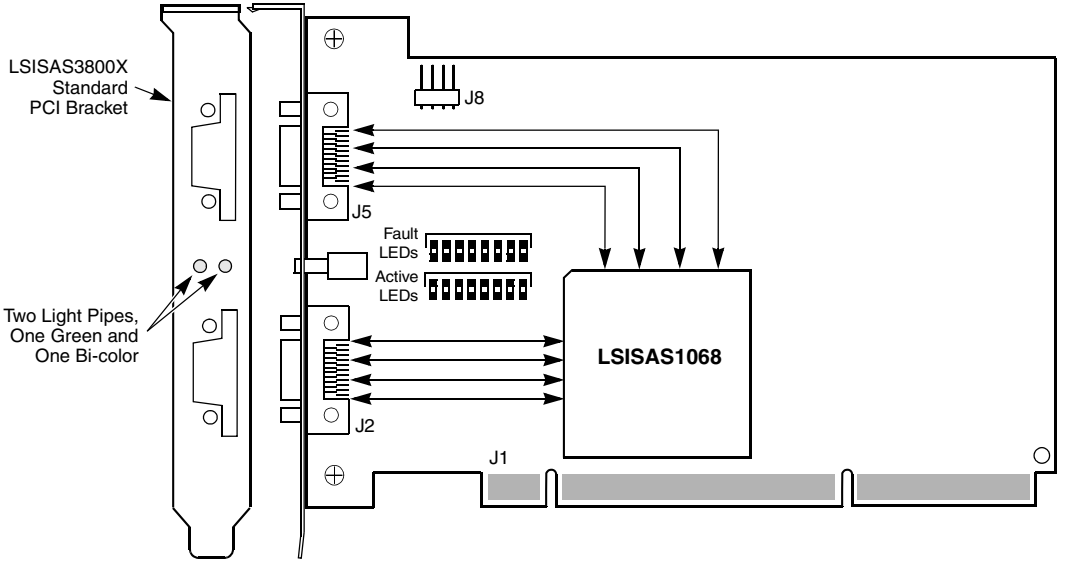
Figure 3.7 LSISAS3800X Board Layout



- J1: PCI/PCI-X 64-bit, +3.3 V type board edge connector
- J2 and J5: SFF-8470 SAS external right-angle connectors
- J8: 4-pin, right angle, 0.1” pitch, pin header for driving external activity LED.

3.1.7.3 Physical Characteristics

The LSISAS3800X board is 6.6 inches x 3.8 inches. PCI/PCI-X connection is made through the edge connector J1. The component height on the top and bottom of the LSISAS3800X board follows the PCI/PCI-X specifications.

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3.2 Electrical and Environmental Specifications

The design and implementation of the LSISAS host adapters minimize electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electrostatic discharge. The board carries the CE mark, C-Tick mark, Canadian Compliance Statement, Korean MIC, Taiwan BSMI, Japan VCCI, FCC Class B and is marked with the FCC Self-Certification logo. The board also meets the requirements of CISPR Class B.

3.2.1 Electrical Characteristics

Table 3.1 lists the maximum power requirements for the LSISAS host adapters under normal operation.

Table 3.1 Maximum Power Requirements

Host Adapters	PCI/PCI-X +5.0 V	PCI/PCI-X +3.30 V	PCI Express +12.0 V	Power	Operating Range
LSISAS3040X	1.5 A	—	—	7.5 W	0 °C to 60 °C
LSISAS3041X, LSISAS3041XL	—	2.26 A	—	7.5 W	0 °C to 60 °C
LSISAS3041E, LSISAS3041EL	—	—	2.34 A	4.4 W	0 °C to 60 °C
LSISAS3442X, LSISAS3442XL	—	2.26 A	—	7.5 W	0 °C to 60 °C
LSISAS3442E, LSISAS3442EL	—	—	3.68 A	6.8 W	0 °C to 60 °C
LSISAS3080X, LSISAS3080XL	—	2.26 A	—	7.5 W	0 °C to 60 °C
LSISAS3800X	—	2.26 A	—	7.5 W	0 °C to 60 °C

The PCI/PCI-X PRSNT1# and PRSNT2# pins are set to indicate 7.5 W maximum configuration at board build time.

3.2.2 Thermal and Atmospheric Characteristics

The atmospheric characteristics for the LSISAS host adapters are:

- Temperature range: 0 °C to 60 °C (dry bulb)

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- Relative humidity range: 5% to 90% non-condensing
- Maximum dew point temperature: 32 °C

The following parameters define the storage and transit environment for the LSISAS host adapters:

- Temperature range: -45 °C to +105 °C (dry bulb)
- Relative humidity range: 5% to 90% non-condensing

3.2.3 Safety Characteristics

All LSISAS host adapters meet or exceed the requirements of UL flammability rating 94V-0. Each bare board is marked with the supplier's name or trademark, type, and UL flammability rating. Because these boards are installed in a PCI, PCI-X or PCI Express bus slot, all voltages are below the SELV 42.4 V limit.

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